

PRELIMINARY RESULTS GAINED FROM USING THE HELIOVIEWER PROGRAM

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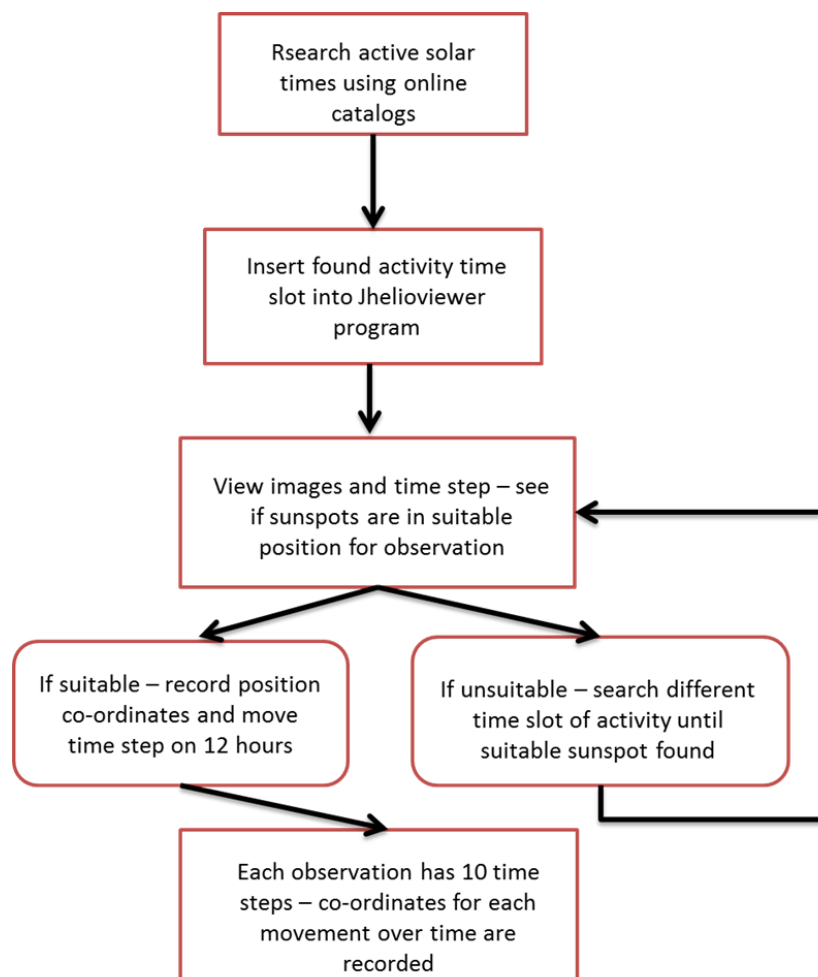
As both members of our group have been working separately, we have both used different methods to track sunspots across the solar surface.

Method 1;

The method of obtaining results works well so far, although we had initial problems with the software which have been resolved. The method is also relatively quick, which means we will be able to obtain lots of data for several different spots to explore the results further.

As you can see from the co-ordinate changes, the spot moves horizontally across the sun over a time step of 12 hours; whilst remaining relatively level on the vertical. The horizontal movement is the one we will be looking at in the most detail, to determine the speed of a travelling sunspot, and therefore the speed of the solar surface.

We have also included a description of the spot observed as we want to use spots from a range of different latitudes on the Sun to explore the idea of the surface moving at different speeds from the poles to the equator.

Flow diagram used to obtain results in method 1;

Results from Method 1;

Description and Initial Date of Observation	Time Step (12hr intervals)	Co-ordinate 1	Co-ordinate 2
01/01/2012 - Group of 3 spots, observing the middle - approx 3/4 down on the Sun	16:38:32	-381.708	-259.338
	04:38:32	-281.911	-256.906
	16:38:32	-178.576	-256.15
	04:38:32	-73.0159	-256.197
	16:38:32	37.003	-254.503
	04:38:32	139.052	-255.957
	16:38:32	242.56	-256.155
	04:38:32	342.828	-258.565
	16:38:32	439.201	-260.083
	04:38:32	529.736	-263.709
02/06/2012 - Pair of spots, taking readings from higher spot - in the 2/4 area of the Sun (2nd quarter down of the Sun)	16:38:32	-586.986	259.72
	04:38:32	-495.074	258.616
	16:38:32	-397.591	257.333
	04:38:32	-247.803	255.616
	16:38:32	-139.822	253.538
	04:38:32	-28.8817	249.867
	16:38:32	80.2248	247.603
	04:38:32	187.949	244.755
	16:38:32	291.287	243.08
	04:38:32	361.59	241.208

Method 2;

Two sunspots at different latitudes have been tracked, with their position recorded, as they move across the solar disk. The two main variables measured are the angular position and the heliographic latitude. These two variables were then used to calculate the angular velocity and the speed. The radius of the cross sectional circle at the heliographic latitude was calculated and then the length of the arc was calculated to get an accurate value for the distance travelled.

Results from Method 2;

Sunspot 1;

		sunspot 1		SS_EGSO_SFC_20141222_185048_2014.12.22T12.54.24.40_275	
date		theta	Theta (radians)	phi	radius (m)
Dec-12	12:43:54	29.32	0.511730537	-69.3	695700000
Dec-13	12:43:54	29.15	0.508763477	-52.35	695700000
Dec-14	12:43:54	29.32	0.511730537	-39.74	695700000
Dec-15	12:43:54	29.53	0.515395728	-27.16	695700000
Dec-16	12:43:54	29.7	0.518362788	-14.45	695700000
Dec-17	12:43:54	29.67	0.517839189	-1.73	695700000
Dec-18	12:43:54	29.76	0.519409985	10.86	695700000
Dec-19	12:43:54	29.9	0.521853446	23.64	695700000
Dec-20	12:43:54	29.79	0.519933584	36.36	695700000
Dec-21	12:43:54	29.48	0.514523063	49.07	695700000
Dec-22	12:43:54	29.15	0.508763477	61.76	695700000
Dec-23	12:43:54	28.99	0.50597095	74.69	695700000
11 days				0	
264 hours	average latitude	29.48	0.514523063		143.99
		0.49		angular velocity	velocity
				0.545416667	degrees per hour
				13.09	degrees per day

Sunspot 2;

Date	time	theta	phi	radius of cross section at latitude
Dec-10	12:43:54	-7.48	-0.130550628	-69.45
Dec-11	12:43:54	-7.61	-0.132819556	-55.83
Dec-12	12:43:54	-7.8	-0.136135682	-42.88
Dec-13	12:43:54	-7.89	-0.137706478	-29.66
Dec-14	12:43:54	-7.92	-0.138230077	-16.25
Dec-15	12:43:54	-7.97	-0.139102741	-3.48
Dec-16	12:43:54	-7.86	-0.137182879	9.6
Dec-17	12:43:54	-7.78	-0.135786616	22.69
Dec-18	12:43:54	-7.65	-0.133517688	36.14
Dec-19			0	
Dec-20	12:43:54	-7.74	-0.135088484	62.97
10 days			0	
240 hours			0	
			0	
			0	
	average latitude	-7.77	-0.135612083	132.42
				695700000
			angular velocity	13.242
				0.55175
				degrees per day
				degrees per hour
				689312615

The values below are the calculated values for the two sunspots in Method 2. We intend to do this for many sunspots, at a variety of different ranges, to show the differential rotation at different latitudes.

latitude	speed
	km/h
29.48	5765.146
-7.77	6638.453